A STUDY ON THE ROLE OF DJ STENTING IN URETERIC CALCULI PATIENTS AFTER INTRACORPOREAL LITHOTRIPSY

Dissertation submitted in partial fulfilment of the

requirements for the degree of

M.Ch – Branch IV (Urology)

THE TAMILNADU DR.M.G.R.MEDICAL

UNIVERSITY, CHENNAI

AUGUST 2013

CERTIFICATE

This is to certify that the dissertation titled "**A STUDY ON THE ROLE OF DJ STENTING IN URETERIC CALCULI PATIENTS AFTER INTRACORPOREAL LITHOTRIPSY"** is a bonafide work done by **Dr.R.ABHIMAN GAUTAM** in partial fulfilment of the requirements for M.Ch. Branch-IV (Urology) Examination of The Tamilnadu Dr. M.G.R. Medical University to be held in **August 2013**.

DEAN

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DECLARATION

I, **Dr.R.ABHIMAN GAUTAM** solemnly declare that the dissertation titled **"A STUDY ON THE ROLE OF DJ STENTING IN URETERIC CALCULI PATIENTS AFTER INTRACORPOREAL LITHOTRIPSY"** is a bonafide work done by me at Govt. Stanley Medical College & Hospital from October 2011 to February 2013 under the guidance and supervision of **PROF.V.SELVARAJ,M.S,M.Ch.,** Professor and Head of the Department of Urology.

The dissertation is submitted to Tamilnadu Dr. M.G.R. Medical University, towards partial fulfilment of requirement for the award of **M.Ch. Degree (Branch-IV) Urology** three years course.

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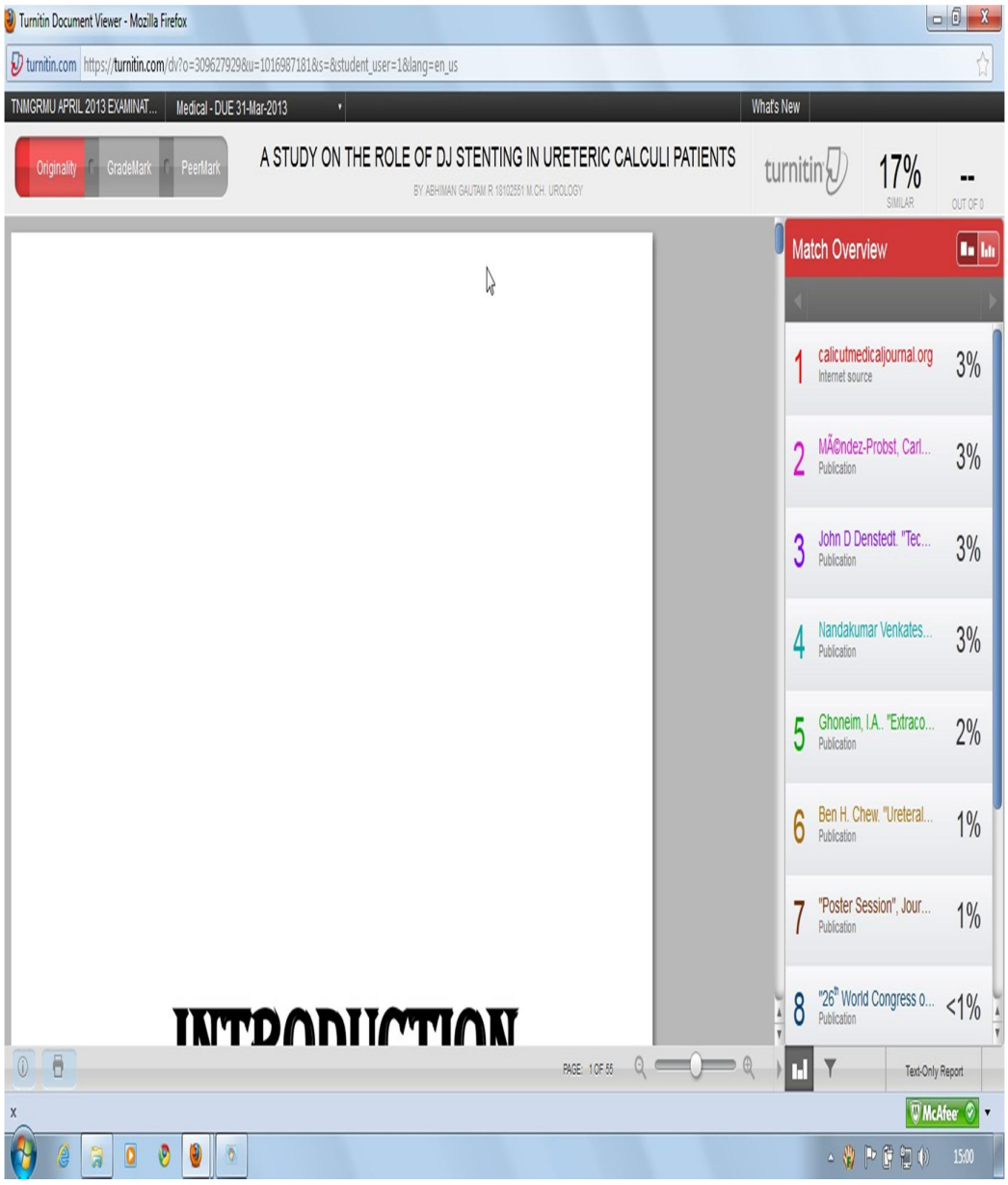
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INTRODUCTION

An ureteric stent, is a tube that is placed inside the ureter to treat and also to prevent urinary obstruction . The stent length ranges from 24 to 30 cm in adults. Cystoscopic placement is the common method used tor stenting. Stents used in ureter are called double J, double pig-tail ,DJ or JJ stents.

The term stent was first coined by Charles T Stent (1807–1885), an English dentist. Stents are commonly indicated in urology for draining urine from the kidney to the bladder. Stenting is mostly done in the ureter for stone disease during definitive procedures like ureteroscopy and extracorporeal shock wave lithotripsy. Advances in instrumentation of ureter have made ureteroscopy less morbid that the stent placed following the procedure remains the main source of concern to the patient. The stent that remains in situ usually causes the symptoms of urinary tract infection, pain in the suprapubic region and flank due to urinary reflux, frequency, urgency, dysuria and hematuria[1].

An ideal stent material should be biocompatible, radiopaque, must relieve intraluminal and extra-luminal obstructions, must be resistant to encrustation and infection, cause little discomfort to the

patient, and has to be widely available at reasonable cost. Upto date, no such stent material fits into all these criteria.

An attempt has been made in this study to evaluate the stent related symptoms after semirigid ureteroscopy and intracorporeal lithotripsy for mid, lower and distal vesico ureteric junction calculi , and a comparison has been made between stented and non stented patients .

REVIEW OF LITERATURE

ANATOMY

The ureter is 22 to 30 cm long, and it transports urine from the renal pelvis to the urinary bladder. The renal pelvis may be intrarenal or extrarenal. It has a capacity of 3 to 10 ml. The ureter begins at the level of first lumbar vertebra. The right ureter is roughly 1 cm shorter than the left ureter. The ureter has an S shaped course in both the transverse and sagittal planes.

There are three narrow points along the course of the ureter where the calculi frequently get lodged and impacted. Those are the ureteropelvic junction, point of crossover of the iliac vessels and the vesicoureteric junction. The latter is the narrowest portion and thus dilatation of this part, usually causes the rest of the ureter to be negotiated easily.

Anatomically the ureter is divided into an abdominal part above the iliac vessels and a pelvic part below them. The abdominal ureter runs on the medial aspect of the psoas muscle, covered by parietal peritoneum and is embedded in subserous fascia. It then crosses over the terminal part of bifurcation of common iliac vessels or over the first part of external iliac vessels and becomes the pelvic

ureter. The pelvic ureter is divided into a lumbar and an iliac segment, both segments being of 8 cm length. The ureters are only 5 cm away from each other in the pelvic portion. They diverge and run inferolaterally along the anterior border of the greater sciatic notch. Then they curve medially into the bladder at its lateral angle and take an oblique 2 cm course through the wall of the bladder .

RADIOLOGY

Radiologically, the ureter is divided into an upper, middle and lower part. The upper part is the portion of ureter above the sacral promontory, middle part runs through the body of sacrum and the lower part lies below the sacrum. With respect to urolithiasis, the radiological classification is used commonly.

In an excretory urogram, the right renal pelvis is usually opposite to the level of L2 vertebra and the left renal pelvis is usually 1 to 2 cm higher. The kidneys may move upto 4 cm during inspiration and the ureters may be kinked, mimicking the appearance of obstruction. So, urograms obtained in the expiratory phase are better. The abdominal ureter passes over the lumbar transverse processes lateral to their pedicles upto the level of L5vertebra, and

then turns medially. Generally, it is considered pathological if an ureter is found 1.5 cm lateral to pedicles of the lumbar vertebrae.

Normal Ureteral diameter at various levels

level	Diameter (mm)	Size (F)
Ureteropelvic junction	2-4	6-12
abdominal	5-6	15-18
Pelvis	4	12
intramural	1.5-3	5-9

HISTORY OF URETEROSCOPY

It was Hugh Hampton Young, who first inspected the upper urinary tract by endoscopy in 1912. He used a cystoscope of 9.5 F size in a pediatric case of megaureter. Lyon and Goodman, in 1977 reported the first usage of rigid ureteroscopes. Eventhough the advent of fibre optic principles heralded the development of flexible ureteroscopes, they have not gained universal acceptance in view of the cost factor and limited capabilities. Initial endoscopes consisted

of relay lenses arranged serially within a hollow tube. The invention of rod lens system by Harold Hopkins revolutionalised the field of endoscopy. It consists of glass rods that substituted the air spaces in the older version of endoscopes. Between the rods are air spaces, that serve as relay lenses. Endoscopic instruments specifically meant for ureteroscopy were initially made by Richard Wolf, the use of which has been reported as early as 1979. Thereafter various sizes of sheaths and working lengths were developed. The incorporation of rod lens system along small size sheaths have enabled ureteroscopy less morbid in recent times.

STENTS

Endoscopic placement of stents to relieve obstruction of the ureter was first described in 1967 by Zimskind. Double J stents and pigtail stent were first introduced by Finney and Hepperlen in 1978.

Stenting is done to drain urine through the ureters , in cases of ureteral obstruction due to stones and other causes like papillary necrosis. Stents are known in urology as double J stents owing to the shape of the coils produced at both the ends in the shape of a J. They are also known as JJ or DJ stents. They are available in different

sizes and lengths. Stents can be open at both ends or have one closed end. The flow of urine in stented patients is facilitated around the stent as it acts as a scaffolding for the ureters.

Indications:

- Extrinsic ureteral obstruction due to retroperitoneal fibrosis and tumours
- intrinsic obstruction of the ureter as a result of stone disease, stricture and tumours.

In both these circumstances, stenting can be either a temporary measure when definitive treatment is being instituted or as a permanent procedure when no definitive treatment is possible such as

- In cases of bilateral obstruction,
- solitary kidney status (anatomically or functionally)
- refractory renal colic
- refractory ureteric obstruction .

Stenting is done as an emergency when obstruction is associated with signs of infection, namely pyuria, leucocytosis and fever. During percutaneous stone removal procedures, ureteral stenting is indicated in the following situations

- associated collecting system perforation
- when the stone burden is high and there is a need for ancillary procedures like extracorporeal shock wave lithotripsy
- edema causing obstruction of the ureter
- coexisting uretero pelvic junction obstruction
- migration of stone fragments into the ureter
- supracostal access
- urinary fistula after removal of nephrostomy tube which is persistent.

Following ureteroscopy for calculi , stenting is indicated when

- calculus impaction is present
- when stone fragmentation is incomplete
- if ureteral dilatation is done during the procedure
- when ureteral perforation occurs during the procedure.

Stents provide the following advantages in ureteroscopy done for calculus disease

- ureteral edema, which is transient following the procedure is byepassed
- stents causes passive dilatation of the ureter, thus aiding in passage of stone fragments

When endopyelotomy or endoureterotomy are performed, a stent that is placed following the procedure aids flow of urine and prevents formation of stricture in the portion of ureter that is incised. In this clinical setting, to aid in complete regeneration of urothelium and avoid stenosis the stent has to be left in place for 6 weeks. This is based on the studies of regeneration of urothelium following Davies intubated ureterotomy.

A stent that is placed following a clinical scenario of either suspected or obvious urinary extravasation due to perforation of the collecting system or ureter, has to be left indwelling for a period of 10 to 14 days. Following ureteroscopic surgery done for upper tract transitional cell carcinoma, stenting period should be upto 1 week in uncomplicated cases.

Stenting of ureter prior to extracorporeal shockwave lithotripsy is indicated

- when stone bulk is more than 2 cm
- extracorporeal shockwave lithotripsy has to be done bilaterally
- in cases of solitary renal status.
- for management of steinstrasse complicating extracorporeal shockwave lithotripsy

Stents can be used for identifying ureter to avoid iatrogenic injury as a landmark during surgery. During laparoscopic surgery, stents that emit light have been used in order to counteract for the lack of tactile sensation and for better visualisation.

When stenting is done in pregnant females for stone disease, consideration has to be given for frequent stent change every 6 weeks , due to the increased occurrence of encrustation of stents as a result of increased excretion of uric acid and calcium in urine. Moreover, the incidence of stent related irritative lower urinary tract symptoms is severe due to the overactive bladder symptoms that occur in later stages of pregnancy.

Stents are also indicated in cases of

- upper urinary tract fistula from a renal or ureteral source
- retroperitoneal urinomas following blunt or open trauma

Stent material should be biocompatible, that is there should not be any tissue reaction and the immune system must not alter or affect it. Immune system stimulation can lead to activation of neutrophils and macrophages and as a result, an inflammatory response ensues due to a foreign material[2,3]. Pain and impaired tissue healing occur as a result of inflammation. Hyprophobic nature and charge are notable properties of the stent material, alterations of which can lead to beneficial effects on the patient. Stent related symptoms can thus be remarkably reduced. In patients undergoing

stenting, greater than 80% have symptoms like urinary frequency, hematuria and flank pain[4].

Stent related symptoms need to be minimised. Primarily, need for stenting during a procedure should be considered taking the stent related morbidity into account. Stent length is a valid factor contributing to stent outcomes. Short stents carry the possibility of migration, that may necessitate surgical removal. Long stents are associated with troublesome symptoms like urgency and frequency, due to excess material in the bladder. The excess length of the stent moves in out at the ureterovesical junction, with relatively little movement intrarenally. In children, a study of 153 patients determined that a suitable length is equal to the patient age in years plus 10 cm [5].

Any stent that crosses the bladder midline causes more irritative lower urinary tract symptoms[6]. Researches have described a number of parameters to determine ideal length of stent like patient height and ureteral measurement by intravenous urogram. Intra operative measurement of length of the ureter correlated better with

the correct stent length than with patient height in a study by Jeon et al [7].

Stent related irritative lower urinary tract symptoms are reduced by alpha receptor blockers that are orally administered compared to placebo[8,9,10].Treatment with oral anti inflammatory agents and narcotics are only effective moderately. Ketorolac, a non steroidal anti inflammatory drug, effectively reduces stent related pain events .Therefore, a Ketorolac eluting stent (Lexington stent ; Boston scientific) was designed and tested in 92 pigs over a 3 month period[11]. Ketorolac levels were high in the ureter. This study demonstrated the advantage of less analgesic use in patients who received the drug eluting stent, but statistically significant improvement in pain scores was not demonstrated [12].

Stent material and design have undergone various modifications. Most stents of the day are made of polyurethane based polymers. Silicone stents have the property of good biocompatibility, they elicit minimal tissue inflammation , and resist encrustation and infection[13]. However advancing silicone based stents over a guide wire is difficult as they are soft. Their usage in

obstruction due to extrinsic compression is quite impossible as they possess low tensile strength [14].

An important aspect of stent in cases of malignant obstruction of ureter caused by bulky lymph nodes or tumor is to resist compression due to extrinsic pathology. Nephrostomy tube insertion is often needed in these patients, particularly if there is an obstruction at the distal ureteric level, where retrograde stent placement becomes difficult. This problem can be circumvented by placement of two double J stents inside the same ureter[15,16], so that when there is blockade of one stent, the other stent drains the ureter.

Metallic stents are being used for malignant ureteral obstruction . They can be left in dwelling for upto12 months as they resist encrustation[17,18] .

Adhesion of bacteria to the stent surface results in formation of biofilms and subsequent infection. Even in patients where the urine is found to be sterile by culture, the stent surface has been found to contain adherent bacteria. Hence, culturing of both urine and stent has to be done in symptomatic stented patients.

Stent biofilms form a surface to which bacteria can adhere, thereby acting as a nidus for infection. Bacterial species such as Pseudomonas species possess the enzyme urease, which catalyses conversion of urea to ammonia, thus urinary pH is raised. A higher pH accounts for crystallization of calcium phosphate and magnesium, that leads to encrustation and further infection. Glycosaminoglycan (GAG), is found normally in urine, and inhibits crystallization naturally. Coating of polyurethane stents and nephrostomy tubes with heparin—a member of the Glycosaminoglycan family—results in decreased biofilm formation and encrustation for a period of 6 weeks following implantation in a study.

Paz et al[19] have showed in their study that the rate of infection is higher in patients who are stented on an emergency basis than elective patients and that stent related infection cannot be prevented by prophylactic antibiotics.

The bacteria gain access to stent materials by means of attachment through components of the outer membrane known as adhesins. Adhesins attach themselves to various components of the

cell structure like collagen, laminin, fibronectin or cell membrane components . As a part of the resistance mechanism, pili or fimbriae develop as filamentous processes , that contain adhesin molecules at their tips. Such type of resistance mechanisms are seen both in gram negative and gram positive bacteria.

Urinary tract infections are commonly caused by gram negative enterobacteriae, Escherichia coli being most common. Uropathogenic Escherichia coli contain pili of the type I variety , contributing significantly to urinary tract infection[20]. The fimbriae express a protein component called fim H, that binds to molecules containing mannose moieties and its adherence to stents placed in the ureter has also been demonstrated[21]. Tamm Horsfall protein comprises of mannose [22] and demonstrate affinity for Escherichia coli species that bind mannose, thus preventing adhesion of bacteria to cells in the bladder [23,24]. Other bacteria like Pseudomonas aeruginosa and Proteus species also demonstrate binding to Tamm horsfall protein laminin, fibronectin, collagen type I and type IV are also recognised by fim H for binding similar to Tamm Horsfall protein [25].

Drug eluting stents are beginning to show some promise for managing stent related events. A stent that elutes triclosan has been reported by Chew et al [26].Triclosan is an antibacterial and antifungal agent. It is a polychlorophenoxy phenol compound. Triclosan has been demonstrated to inhibit the growth of Proteus mirabilis, Klebsiella pneumonia, Enterococcus faecalis and Staphylococcus aureus. The inhibition of tumor necrosis factor by triclosan has also been reported by Elwood et al.

A metallic stent that elutes the chemotherapeutic agent paclitaxel has been reported by Liatsikos et al[27]. Initial reports in pigs, comparing the paclitaxel eluting stent with non eluting stents as control have shown reduced inflammatory and hyperplastic activity at the tissue level [27].Human trials are being awaited for this stent .

Tachyplesin III , a peptide with anti bacterial properties has been tested for stent elution in a trial. Tachyplesin III has been tested alone and in combination with piperacillin-tazobactum for inhibition of Pseudomonas aeruginosa[28]. Similar results have been demonstrated for BMAP-28, a peptide against Staphylococcus aureus and Enterococcus faecalis by Orlando et al. in animal models.

Stents that are biodegradable have been contemplated in the past. A stent, made of caprolactone, glycolic acid and L-lactide has been reported. Initial studies in porcine models have demonstrated reduced rates of infection compared to polyurethane stents. A stent that is biodegradable is presumed to have less attachment to bacteria and thus reduced incidence of stent related events.

Stent insertion:

The retrograde approach is used most often than the antegrade approach. It is employed as an adjunct to ureteroscopy or extracorporeal shock wave lithotripsy. When using a retrograde approach fluoroscopy and guide wires are required for retrograde insertion of stents, irrespective of whether flexible cystoscopy or rigid cystoscopy is used. The best and easiest means of placing an ureteral stent is by advancing it over a guidewire. A guidewire is initially passed through a cystoscope into the visualised ureteric orifice. Then a stent that has both ends open is advanced over the guidewire with a pusher under direct cystoscopic vision of the ureteric orifice into the ureter to the level of renal pelvis. Advancement of the stent up the ureter has to be fluoroscopically

monitored. The stent is let to curl in the bladder when the pusher becomes visible at the level of the bladder neck, by extracting the guidewire completely. More reliance has to be placed on fluoroscopic monitoring rather than cystoscopy when stenting is done in cases of malignant obstruction and impacted ureteral stones. Initial cystoscopy, either rigid or flexible is done, and a floppy tip guidewire is advanced into the ureteric orifice and coiled in the renal pelvis using fluoroscopy. Then , the cystoscope is removed and an 8- to 10-Fr coaxial dilator is advanced under fluoroscopy until the 10-Fr sheath is at the urethral meatus. The 8-Fr internal dilator is removed, leaving the 10-Fr outer sheath in situ. Stent that has been passed into the guidewire is then advanced through the 10-Fr sheath by using a pusher, that has a fluoroscopically visible metal band at its tip. The pusher is then advanced under fluoroscopic guidance to the upper border of the pubic symphysis in male patients and lower border of the pubic symphysis in female patients, while lower end of the stent is being stabilised. The 10-Fr sheath and subsequently the guidewire are removed, allowing the stent to curl in the bladder.

COMPLICATIONS

Apart from stent related events that follow stenting, it has unique complications of migration and encrustation. The occurrence of stent migration has been reported in the literature in upto 3.7 %. This is due to discrepancy of ureteric and stent length, the stent being shorter. Migration can be prevented by attachment of a withdrawal string at the distal end. It also provides the added benefit of avoiding cystoscopic stent removal, which adds morbidity to the patient.

A stent is a foreign material and when exposed to urine for a longer period of time , is prone to get encrusted. Stent encrustation tends to get worsened with increased indwelling time and coexisting infection with urease-producing organisms. Oxalate is normally broken down in the gastrointestinal tract by the enzyme oxalate decarboxylase, that is found in a commensal organism Oxalobacter formigenes. When oxalate is not degraded bacterially and escapes excretion through faeces, it is absorbed into the bloodstream and results in filtration by the kidneys. In kidneys, under certain circumstances it can combine with calcium to form calcium oxalate

calculi. The composition of encrustation in a stent is predominantly calcium based, and so a plain x ray KUB (kidney, ureter, bladder) gives a good estimate of the degree and extent of encrustation around the stent. In cases of radiolucent uric acid stones, where x ray cannot reveal the stone, a CT scan and ultrasound are needed. A rough estimate of the encrustation burden can be made by multiplying the width and length of the encrustation made out on imaging. In general, when the stone burden is >400mm^2, the patient needs to be subjected to a multimodality approach for complete stone clearance. In cases of extensive stone burden, split renal function needs to be assessed with a radionuclide study. This is for documentation of preoperative renal function of the affected side.

In cases of minimal encrustation, retrograde cystoscopic removal can be attempted. It is prudent to visualise the proximal end of the stent fluoroscopically during the procedure to confirm uncoiling at the proximal end. When resistance is encountered or the patient complains of pain, the procedure has to be terminated. Extracorporeal shockwave lithotripsy can be attempted as high success rates have been reported in this setting. This can be followed by cystoscopic removal.

When significant encrustation is noted in the ureter, ureteroscopy with laser lithotripsy can be attempted. In cases where simultaneous passage of an ureteroscope is not possible along with the stent, placement of a new stent alongside the previous one can be done and interval cystoscopy can be planned later. Meanwhile, the new stent aids in passive dilatation of the ureter. Significant encrustation of the distal intravesical portion of the stent can be dealt with by cystolitholapaxy. When the proximal coil of the stent is associated with a stone burden of more than 2 cm, percutaneous stone removal procedures should be undertaken.

AIM

To evaluate the efficacy and complications of Double J stenting in ureteric calculi patients, who underwent semi rigid ureteroscopy and pneumatic lithotripsy.

MATERIALS AND METHODS

It is a prospective study conducted from October 2011 to February 2013. A total of 70 patients were enrolled in the study.

Inclusion criteria:

- Patients who underwent semirigid ureteroscopy for uncomplicated ureteric calculi.
- Only uncomplicated vesico ureteric junction calculi, lower ureteric calculi and mid ureteric calculi were included in the study.

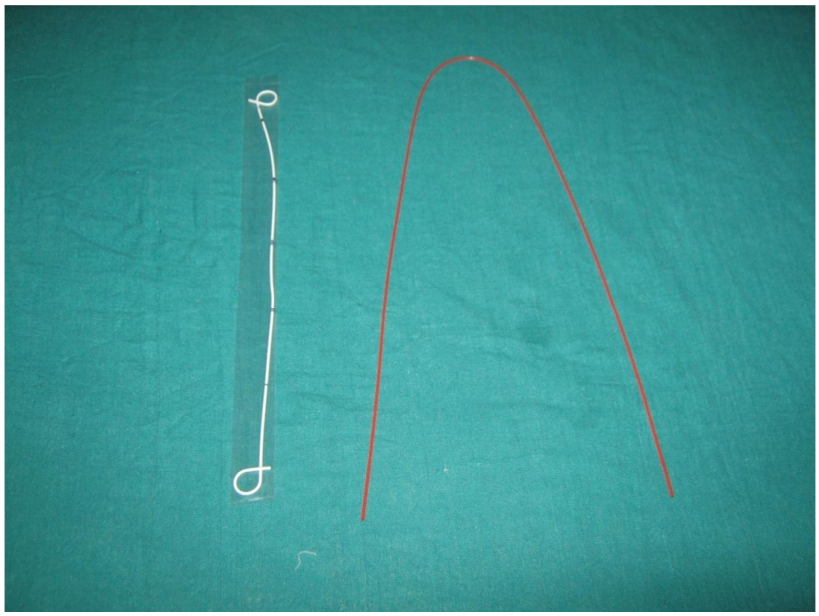
Exclusion criteria:

- Patients with upper ureteric calculi
- Calculi associated with impaction and edema made out during ureteroscopy
- Calculi associated with difficult entry of ureteroscope into the ureteric orifice.
- Patients who underwent balloon dilatation of the ureteric orifice.

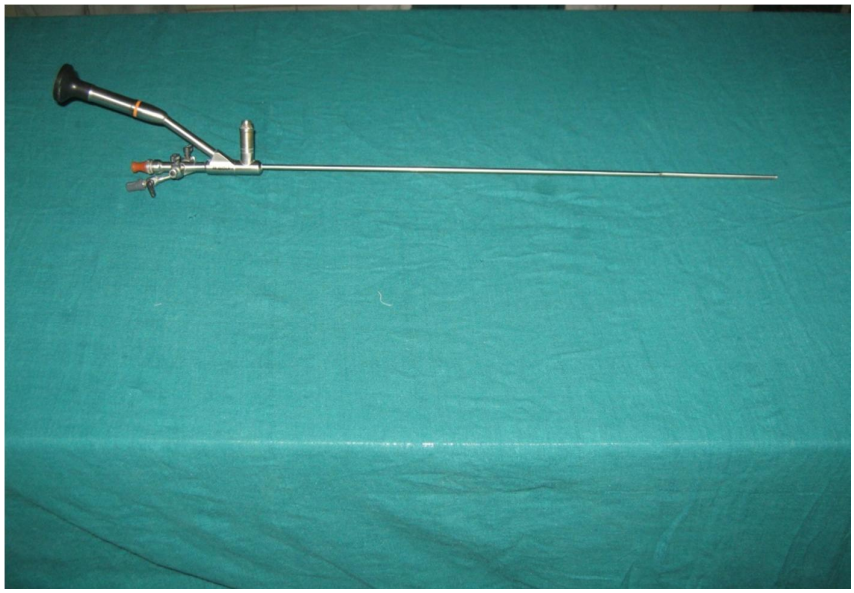
- Patients with residual stone fragments in the ureter, post procedure.

The preoperative work up of patients included general physical examination of the patient, ultrasound KUB (kidney, ureter, bladder) to make out the site, size of calculus and proximal pelvicalyceal and ureteric dilatation, plain X-ray KUB (kidney, ureter, bladder) also to make out the size and location of stone and intravenous urogram to make out the degree of obstruction caused by the calculus and excretion status of the renal units. CT scan KUB (kidney, ureter, bladder) plain was done in cases of suspected radiolucent calculi that could not be visualised in plain X-ray.

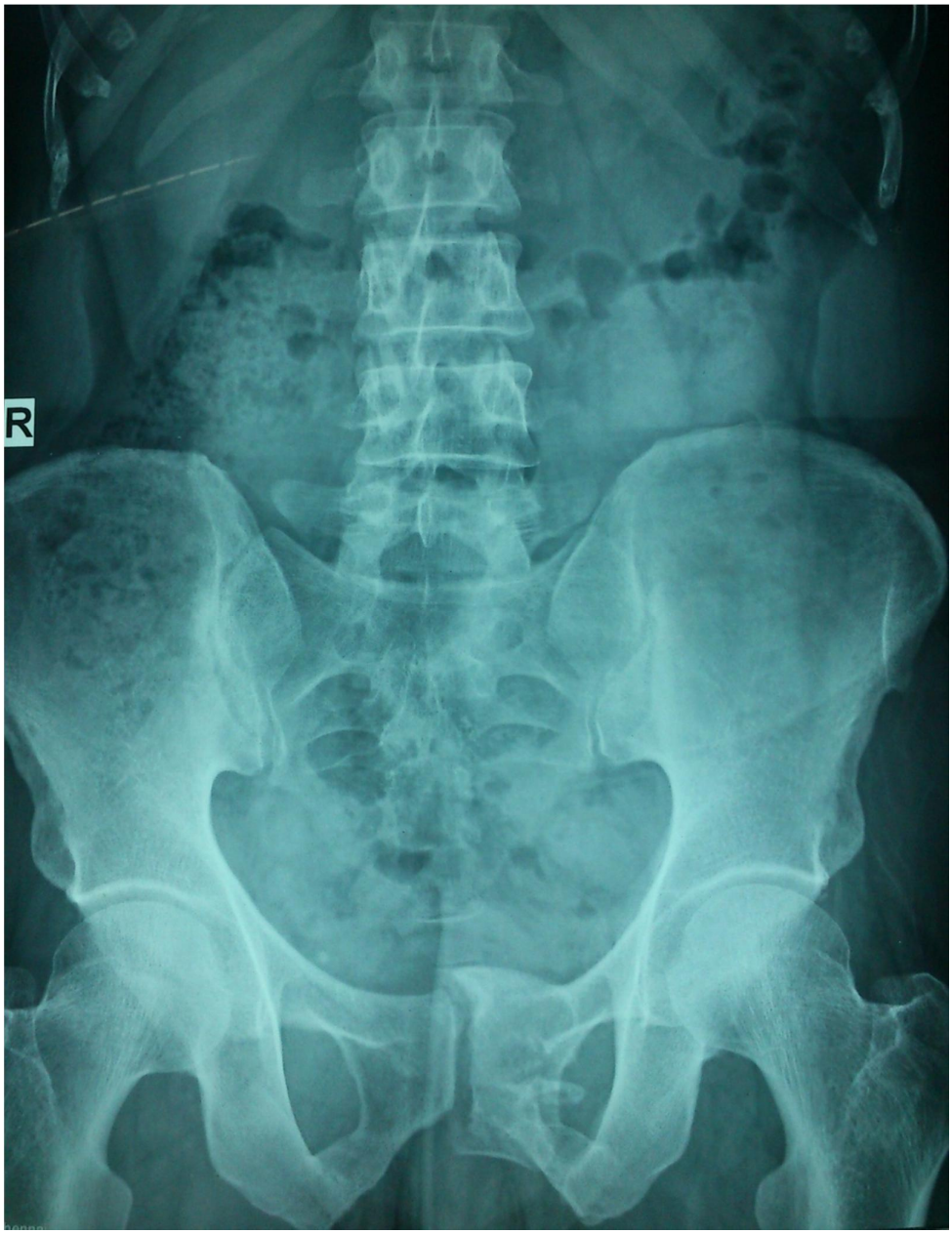
Under spinal anesthesia, patient was placed in the lithotomy position with the ipsilateral leg lower and straighter to facilitate easy ureteroscope entry. Cystoscopy was done using 20 F sheath, 30 degree scope . The entire urethra assessed and bladder visualised for any associated pathology. Both the ureteric orifices were visualised and 0.032 inch guidewire passed into the ipsilateral ureter containing the calculus. Then the cystoscope was removed and 8 F infant feeding tube passed into the bladder. 8/9.8 F semirigid ureteroscope



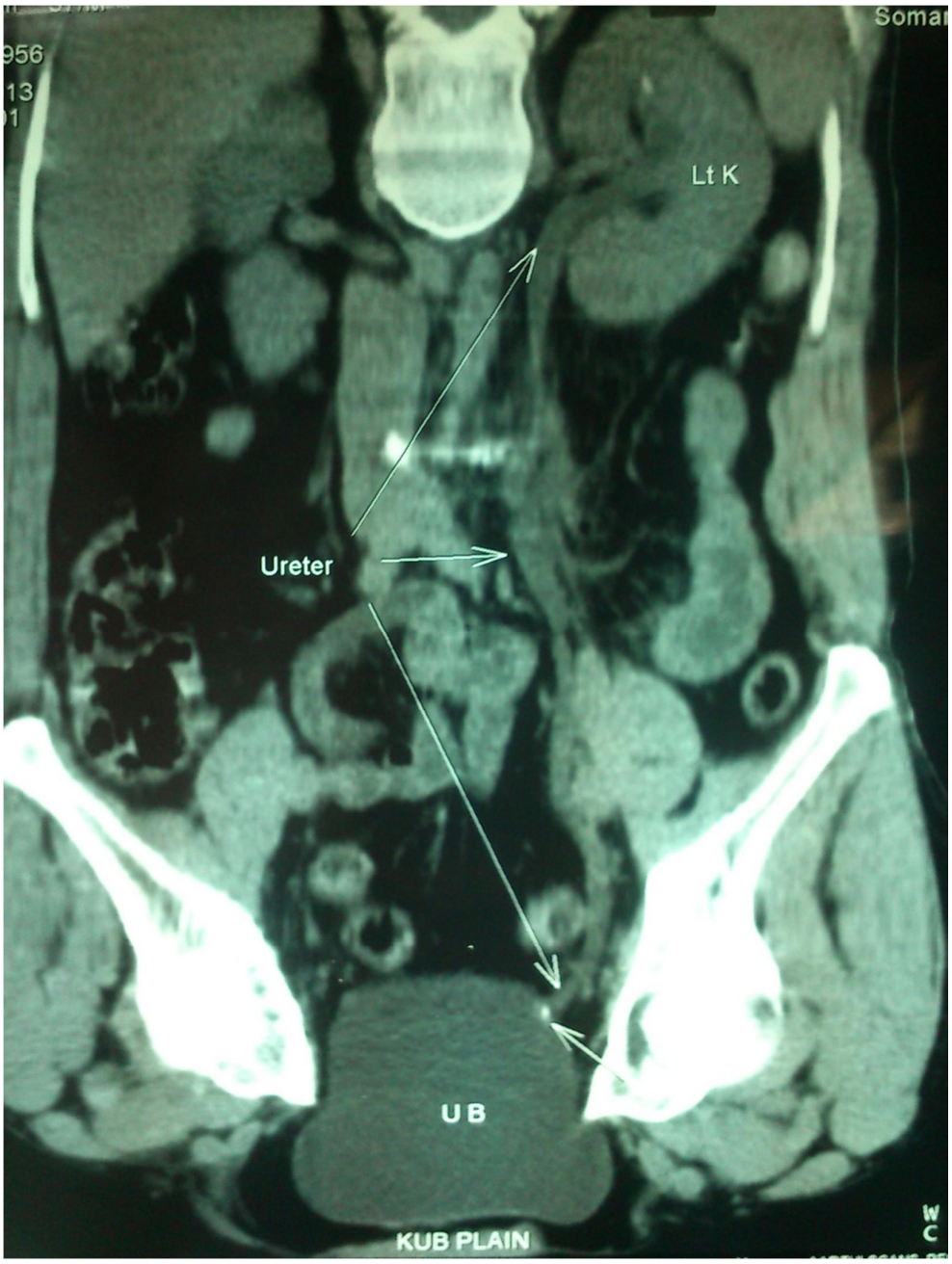
26 cms 5 F one end closed DJ stent and the pusher used in the study



8 / 9.8 F ureteroscope used in the study



Plain X-ray KUB (kidney, ureter, bladder) showing a right vesico ureteric junction calculus.



Plain CT KUB (kidney, ureter, bladder) showing a left vesico ureteric junction calculus.

was passed into the ureter under normal saline irrigation and passed proximally until the calculus was visualised. Patients with intra operative findings of difficult ureteroscope entry, dense stone impaction, edema and bleeding were excluded from the study. Patients who underwent balloon dilatation of the ureteric orifice were also excluded from the study. Then pneumatic lithotripsy was done and stone fragmentation completed. Patients with residual stone fragments in the ureter, post procedure were excluded from the study. Patients who underwent ureteroscopy and lithotripsy for uncomplicated ureteric calculi were stratified into two groups. Among the total of 70 patients, 35 patients were stented with a 5 F, one end closed, 26 cm double J stent and 35 patients were not stented and were followed up in the post operative period and observed for pain, urinary frequency, hematuria and fever . All patients were discharged on the second post operative day. All patients were again reviewed two weeks later. Those patients who were stented were advised an X-ray KUB(kidney, ureter, bladder), their stent position was confirmed and stent removal was done after two week scystoscopically as an outpatient procedure.. This study comprised of 27 vesico ureteric junction and 38 lower ureteric

calculi. It comprises of only 5 mid ureteric calculi patients as most of the patients who underwent ureteroscopy could not be included in the study owing to the presence of associated edema and stone impaction. Patients with residual stone fragments that were detected on post operative plain X-ray KUB(kidney, ureter, bladder) were excluded from the study.

RESULTS AND DISCUSSION

RESULTS

The average age of the patients in stented and non stented groups were 36.1 and 38.5 years respectively with the age range varying from 13 to 63 years comprising of both groups. The size of the calculus varied from 6 to 14 mm comprising of both groups with a average size of 8.9 mm in the stented group and 8.5 mm in the non stented group of patients.

TABLE NO 1 - AGE AND SIZE

	STENTED GROUP	NONSTENTED GROUP
AVERAGESIZEOF CALCULUS	8.9mm	8.5mm
STONE SIZE RANGE	6-14 mm	6-12 mm
AVERAGE AGE	36.1 yrs	38.5 yrs
AGE RANGE	13-56 yrs	13-63 yrs

The composition of each group- stented and non stented according to sex was as follows. Of the 70 patients enrolled in the study, in the stented group, there were 22 males and 13 females. In the non stented group there were 18 male and 17 females.

TABLE NO 2 – SEX DISTRIBUTION

	STENTED GROUP	NONSTENTED GROUP
MALES	22 (62.8%)	18 (51.4%)
FEMALES	13 (37.1%)	17 (48.5%)

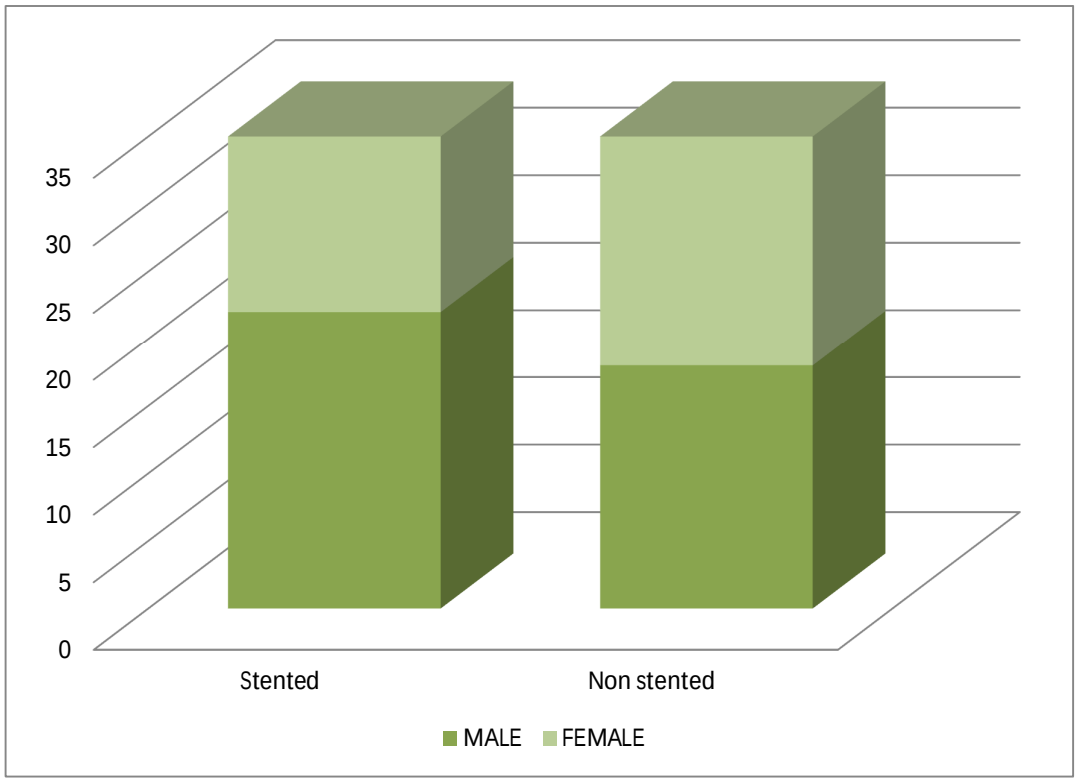


CHART 1 : **Chart showing the composition of patients according to sex (male/female) in both stented and non stented group**

When the side of the ureter dealt with by ureteroscopy was taken into account, among 70 patients enrolled in the study ,the stented group had 19 right sided and left sided ureteric calculi. In the non stented group, there were 18 patients with right sided calculi and 17 patients with left sided calculi.

TABLE NO 3 – SIDE OF CALCULI

	STENTED GROUP	NONSTENTED GROUP
RIGHT SIDE	19 (54.2%)	18 (51.4%)
LEFT SIDE	16 (45.7%)	17 (48.5%)

With regard to location of the calculus, most of the patients comprised of lower ureteric (38) and vesico ureteric junction calculi (27) and few (5) mid ureteric calculi. The number of patients with mid ureteric calculi was low compared to lower and vesico ureteric junction calculi in the study as the cases with mid ureteric calculi were complicated in most of the instances. The composition is as follows.

TABLE NO 4 – SITE OF CALCULI

	STENTED GROUP	ONSTENTED GROUP
LOWER URETERIC	20(57.1%)	18 (51.4%))
VESICO URETERIC JUNCTION CALCULI	12(34.2%)	15 (42.8%)
MID URETERIC	3 (8.5%)	2 (5.7%)

All the enrolled 70 patients with regard to distribution according to age, stone size, stone location, side of the stone and sex were stratified into non stented and stented groups. The operative procedure and associated complications were explained to the patient and formal informed written consent was obtained.

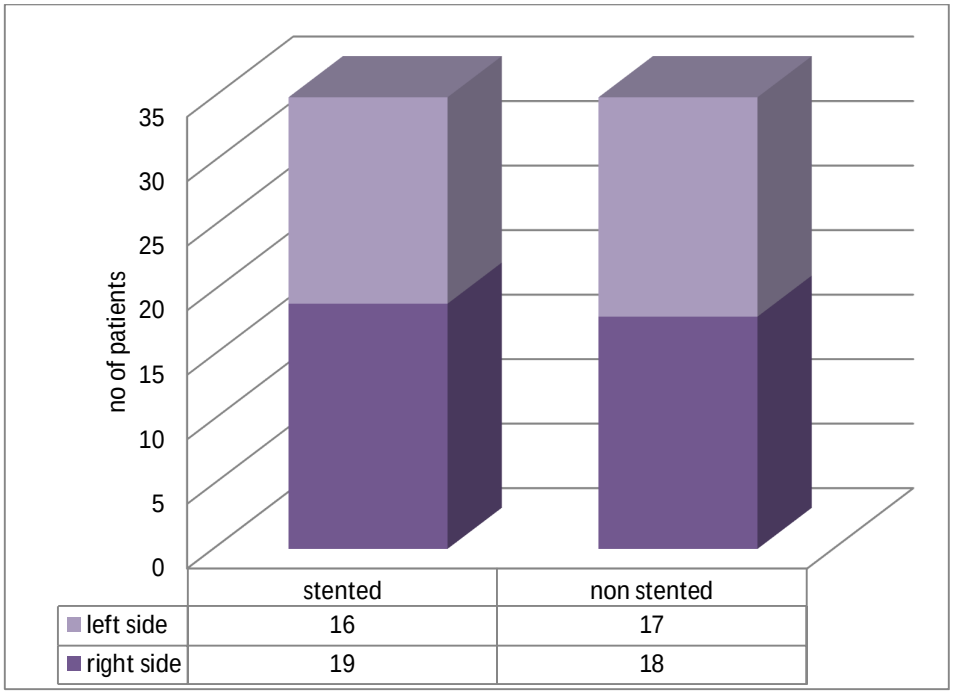


CHART 2 : Chart showing the distribution of patients in the study group (both stented and non stented) with respect to side of calculus (right and left)

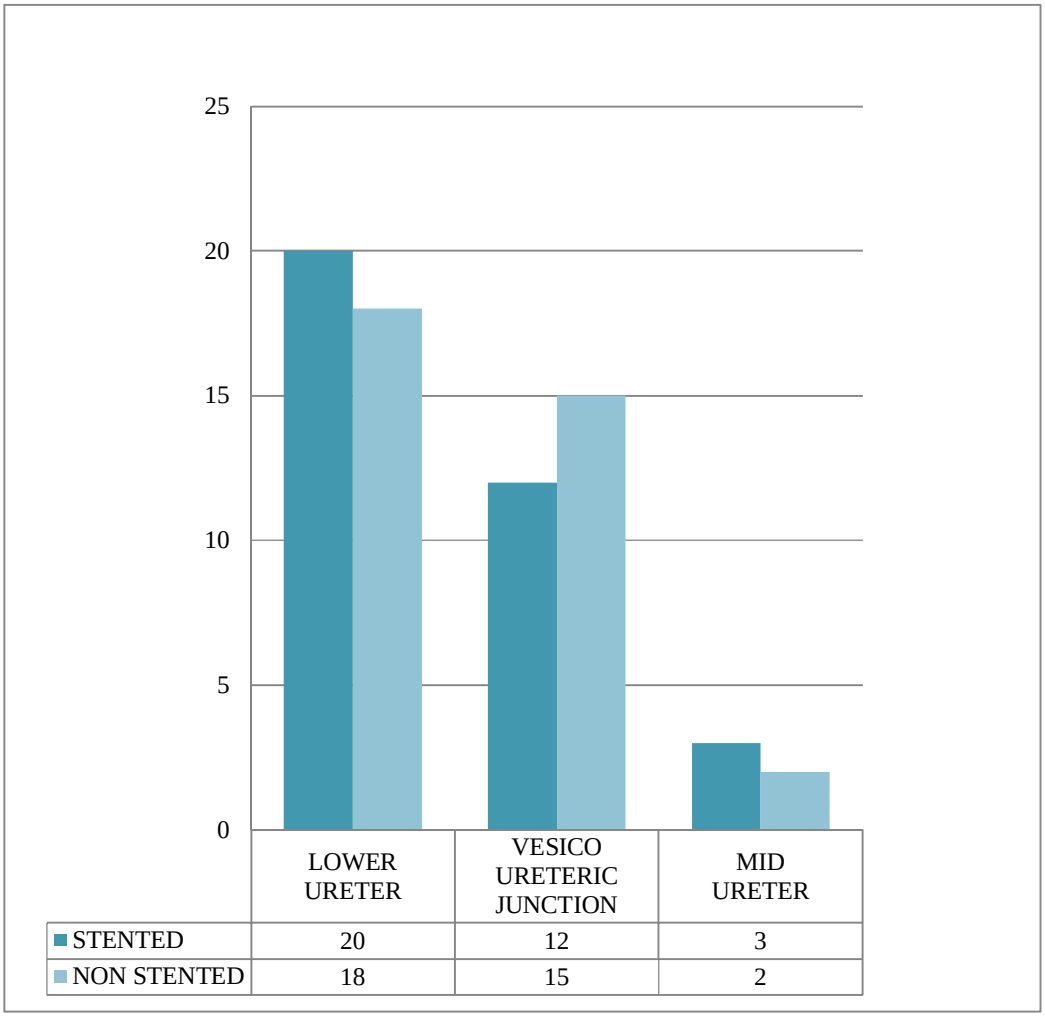


CHART 3 : **Chart showing distribution of patients in the study group (stented and non stented) according to the site of calculus (mid ureter, lower ureter, vesico ureteric junction)**

The parameters that were studied in the patients were urinary frequency (irritative lower urinary tract symptom), loin pain, fever and hematuria. The patients were evaluated for the above parameters in the post operative period and again after two weeks , when they were reviewed. Ideally the incidence of stricture formation has to be taken into account as a complication following ureteroscopic instrumentation. But in our study the incidence of stricture in the ureter following ureteroscopy was not taken into account as the period of study has to be extended.

Meanwhile, the patients who were symptomatic with respect to the above mentioned parameters who attended the out patient clinic in the intervening two weeks period were also taken into account. The number of patients who were symptomatic with respect to the parameters mentioned were entered in the study in both stented and non stented group and were compared. Their statistical significance was calculated by the chi square test.

The overall incidence of the symptoms mentioned (urinary frequency, pain, hematuria and fever) among both the group of patients who were enrolled in the study was as follows.

TABLE NO 5 – STUDY PARAMETERS

	STENTED	NON STENTED
FREQUENCY	18 (51.4%)	5 (14.2%)
PAIN	17 (48.5%)	6 (17.1%)
FEVER	10 (28.5%)	4 (11.4%)
HEMATURIA	7 (20%)	2 (5.7%)

FREQUENCY:

The symptom of urinary frequency was noted in 18 out of 35 stented patients (51.4%)and 5 out of 35 (14.2%) non stented patients. It is generally said that presence of a stent coiled inside the bladder causes irritative lower urinary tract symptom of urinary frequency. This symptom is more pronounced in patients were the intravesical portion of the stent is longer and particularly if the stent crosses the midline of the bladder and irritates the trigone. Among the 23 patients who had urinary frequency, 6 patients (5 stented and 1 non stented) had severe symptoms and attended the out patient clinic. They were evaluated with urine analysis, and were treated with alpha receptor blocker Tamsulosin 0.4 mg once daily. Among the 6 patients, 2 patients had urinary tract infection that was documented by culture and sensitivity and treated with culture specific oral antibiotics.

The statistical analysis of the symptom of frequency in the study group was as follows.

TABLE NO 6- COMPARISON OF STENTED AND NON STENTED PATIENTS FOR URINARY FREQUENCY

STENT STATUS	FREQUENCY ABSENT	FREQUENCY PRESENT	TOTAL
Non stented	30	5	35
stented	17	18	35
total	47	23	70

p=0.001

Graphical representation of the incidence of urinary frequency in the study group is as follows:

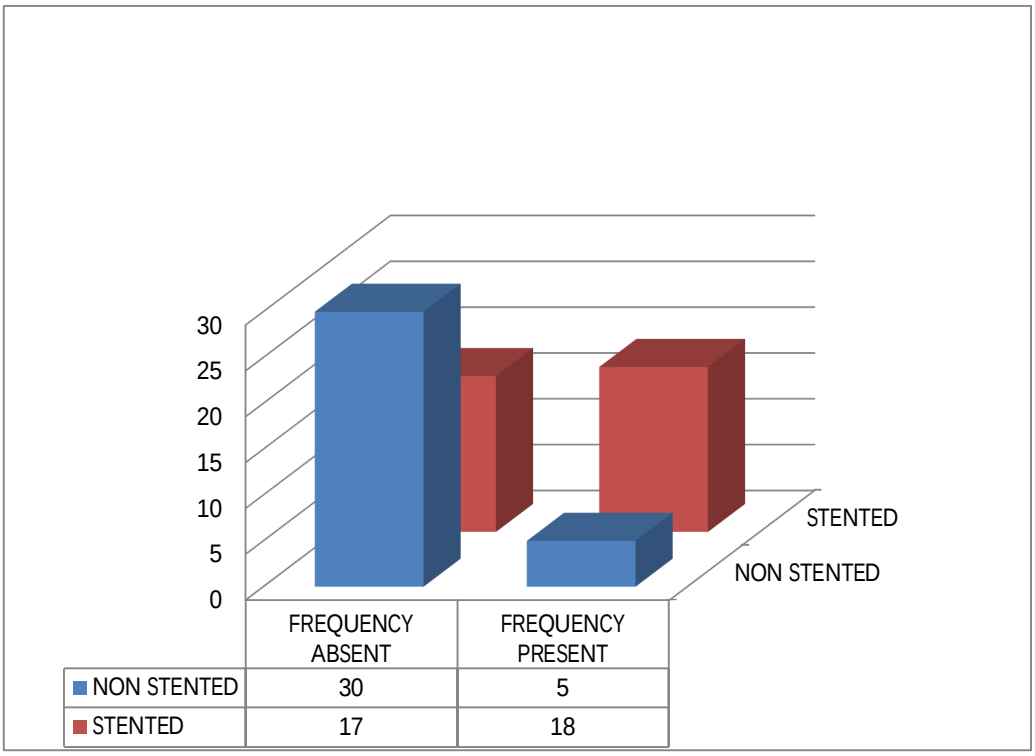
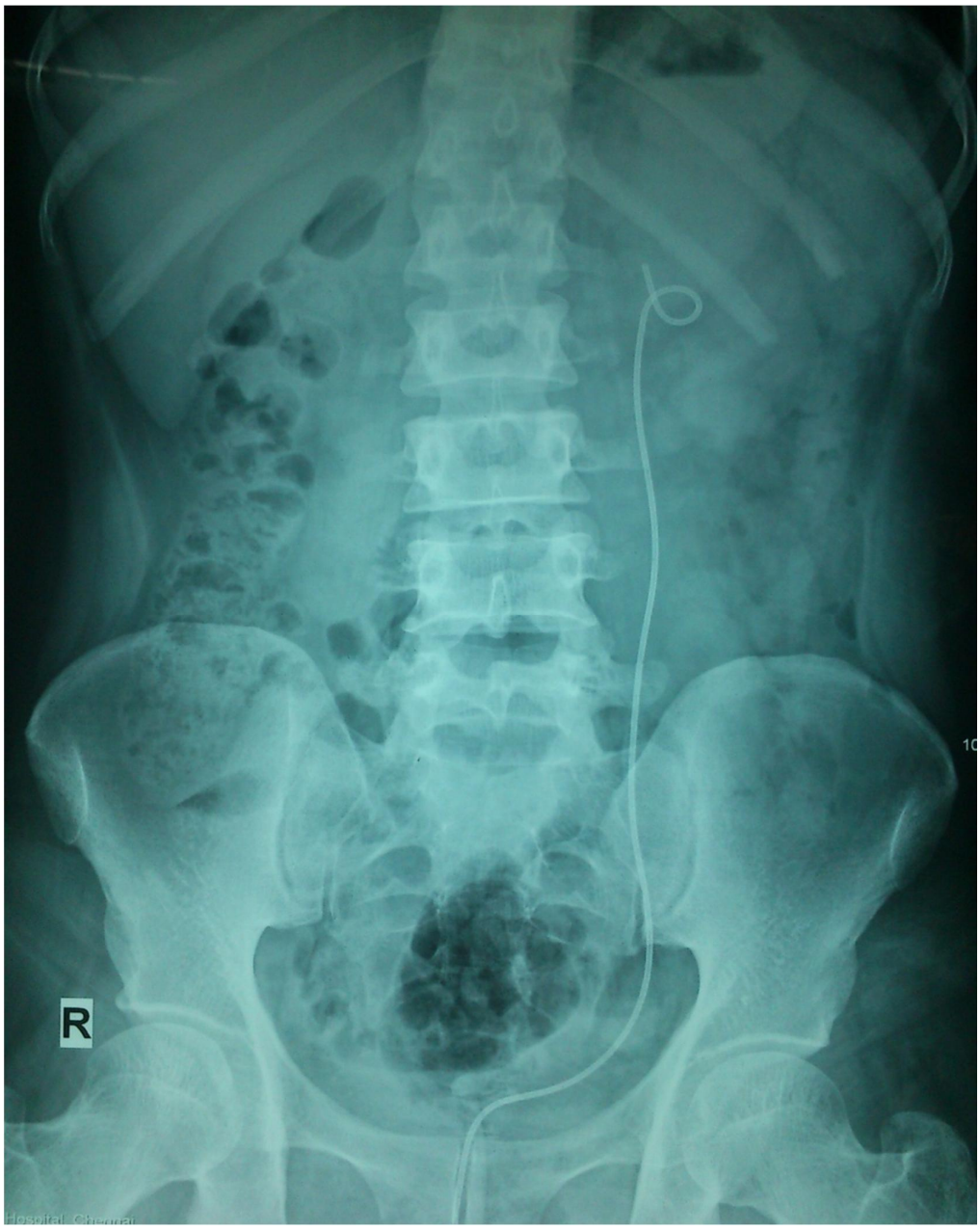


CHART 4: **Chart depicting incidence of the symptom of frequency in the study group (both stented and non stented) . frequency was observed more in the stented group (18) than in the non stented group (5). statistical significance (p=0.001) was noted.**

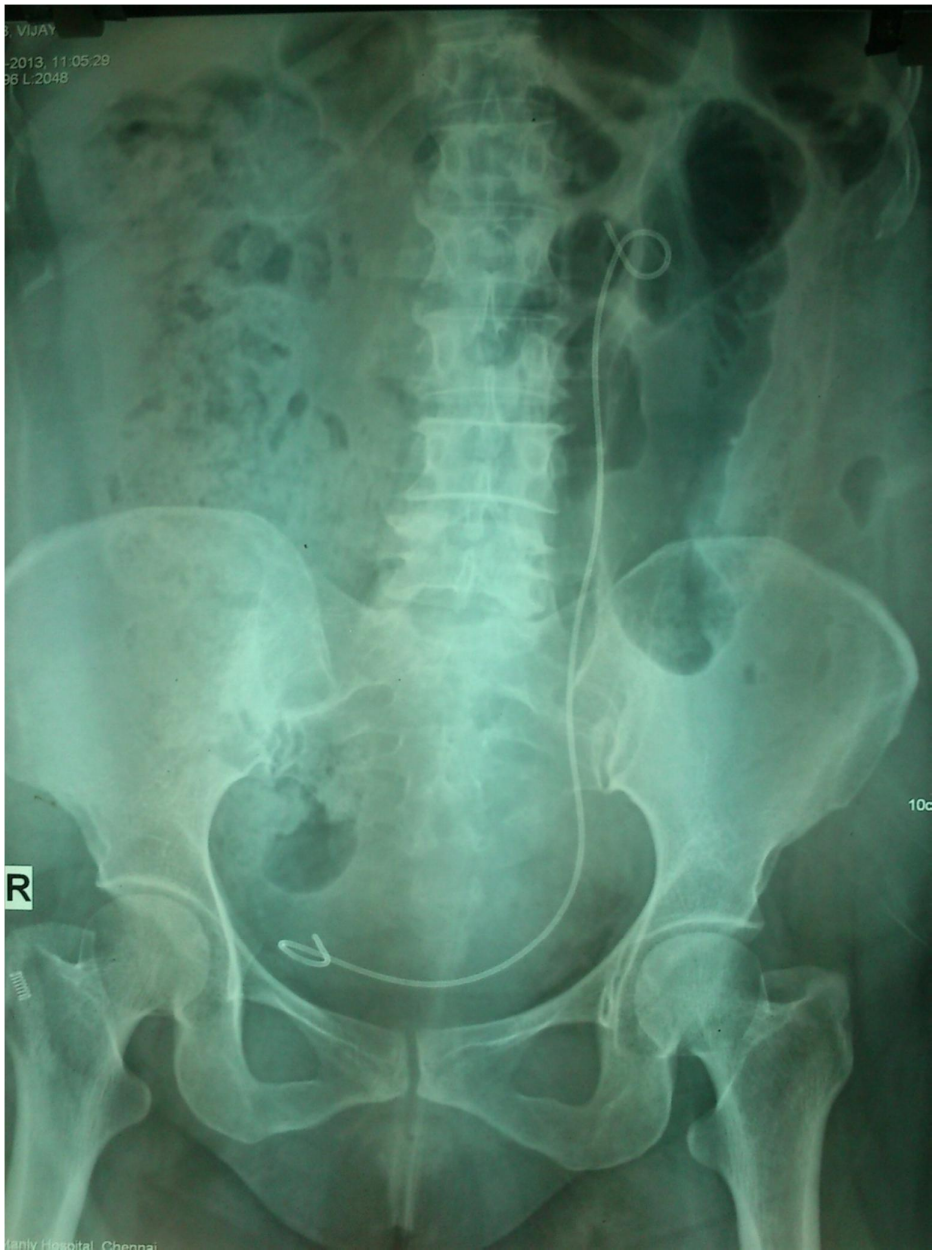
The statistical analysis for urinary frequency in comparing both groups revealed statistical significance ($p<0.005$), as calculated by chi square test.

PAIN:

The symptom of pain, particularly ipsilateral loin and suprapubic pain was noted in 17 out of 35 (48.5%) stented patients and 6 out of 35 (17.1%) non stented patients. The incidence of pain could be attributed to both procedural pain and stent related pain. . But, it was noted that the incidence of pain in the stented group was substantially higher (48.5%) compared to the non stented (17.1%) group. All 23 patients (17 stented and 6 non stented patients) were treated with oral dicyclomine10 mg given twice daily and oral paracetamol 500 mg given twice daily for control of pain. In 4 patients the pain was severe , and they were treated with oral non steroidal anti inflammatory drugs. Statistical analysis of pain comparing both groups showed the following results.



Plain X-ray KUB (kidney, ureter, bladder) showing a left ureteric DJ stent, the lower end was seen protruding into the urethra. This patient had severe urinary frequency and urgency.



Plain X-ray KUB (kidney, ureter, bladder) showing a left ureteric DJ stent with the intra vesical portion seen to cross the midline. This patient had severe urinary frequency.

TABLE NO 7 –COMPARISON OF STENTED AND NON STENTED PATIENTS FOR PAIN

Stent status	Pain absent	Pain present	total
Non stented	29	6	35
stented	18	17	35
total	47	23	70

p=0.004

The results showed that the incidence of pain was statistically significant ($p<0.005$) in the stented group compared to the non stented group. Percentage wise, incidence of pain in the stented group was substantially higher (48.5%) compared to the non stented (17.1%) group.

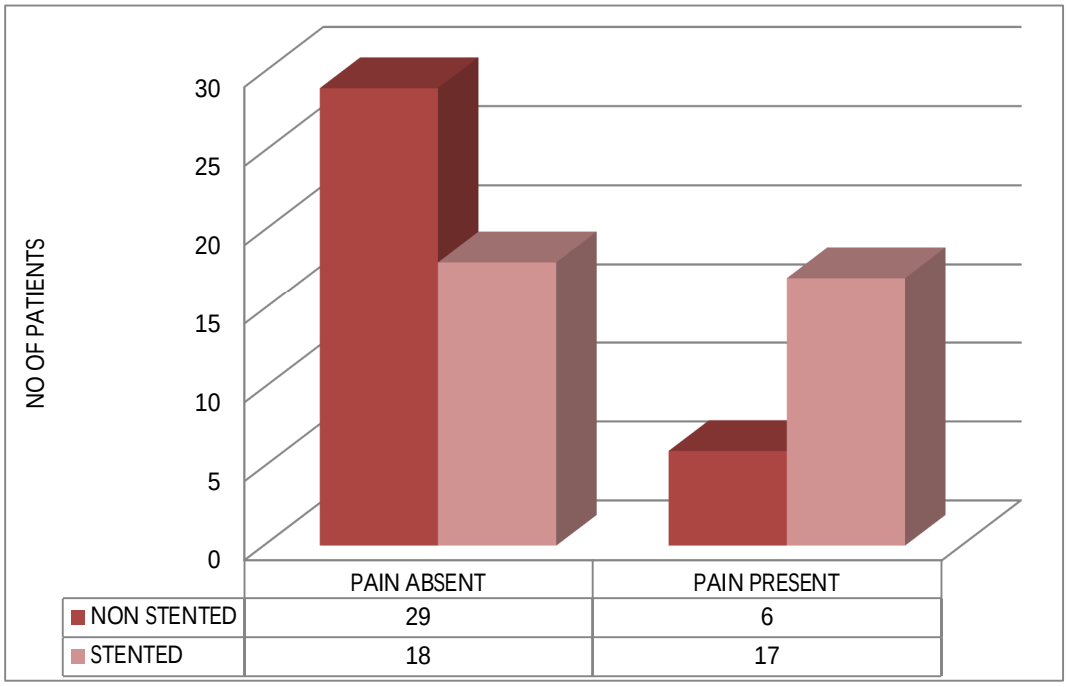


CHART 5 : **Chart showing the incidence of pain in the study group (stented and non stented). pain in the stented group was observed in 17 stented patients compared to 6 non stented patients . statistical significance was noted (p=0.004)**

FEVER:

Among the 70 patients enrolled in the study, 10 out of 35 patients in the stented group (28.5%) and 4 out of 35 (11.4%) patients in the non stented group had fever. Fever in the study group patients varied from a temperature range of 99 F to 100.8 F with a mean temperature of 99.6 F. Among the 14 patients with fever, 3 patients were admitted and treated with culture sensitive parenteral antibiotics. In all 14 patients with fever, urine culture and sensitivity was done and 10 patients were found to be culture positive (8 patients for Escherichia coli, 2 patients for Klebsiella species)and treated with oral antibiotics in 7 patients and parenteral antibiotics in 3 patients.

Fever can be attributed to both the possibility of infection related to the procedure and stent related infection. Statistical analysis of fever in comparing both groups yielded the following results.

Plain X-ray KUB (kidney, ureter, bladder) showing a right ureteric DJ stent with stone fragments in the distal portion of the stent. This patient was excluded from the study.

TABLE NO 8 – COMPARISON OF STENTED AND NON STENTED PATIENTS FOR FEVER

Stent status	No fever	Fever present	Total
Non stented	31	4	35
stented	25	10	35
total	56	14	70

p=0.65

From the study group, it was made out that the incidence of fever was more in the stented group compared to the non stented group (28.5% vs 11.4%) . But the outcomes were not statistically significant (p>0.005), as calculated by the chi square test.

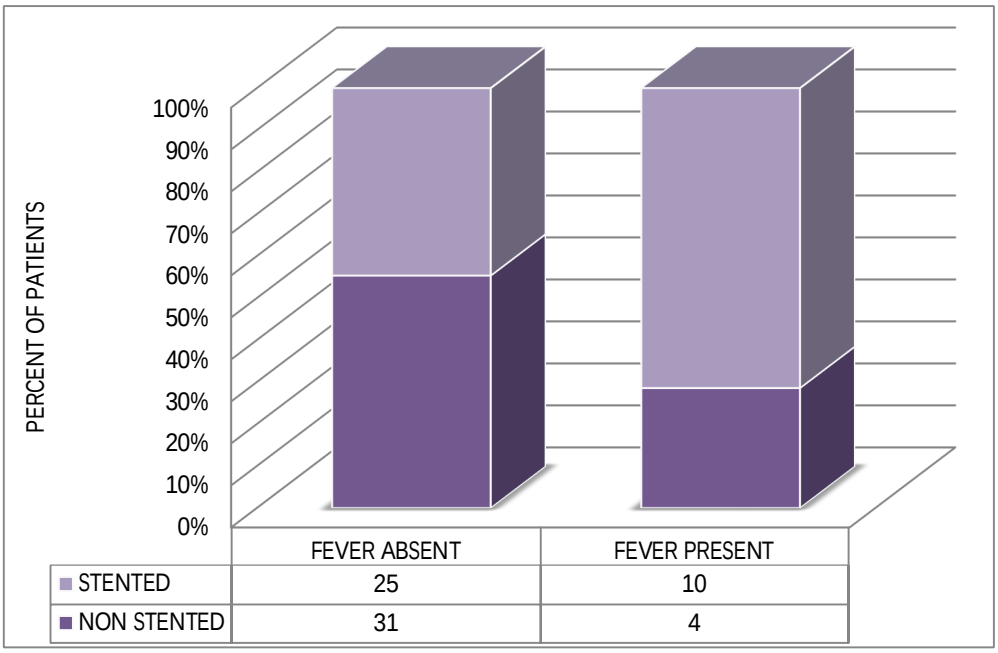


CHART 6: **Chart showing the incidence of fever in the study group (both stented and non stented).10 stented and 4 non stented patients had fever . it was not statistically significant (p=0.65)**

HEMATURIA:

Evaluation with regard to the symptom of hematuria showed that , the incidence was 7 out of 35 (20%) patients in the stented group and 2 out of 35 (5.7%) in the non stented group. All 9 patients were enrolled positivity for hematuria only after urine analysis showed more than 3 RBCs/high power field. In fact to be precise, 13 patients gave history of hematuria and 4 patients were excluded positivity after their urine analysis was negative for RBCs.

The symptom of hematuria is due to the stent causing irritative effects on the bladder mucosa as well as procedure related. Those patients who had obvious bleeding intra operatively during the procedure were excluded from the study, as those patients had to be invariably stented to prevent obstruction , as a result of possible clot retention. All 9 patients with hematuria were treated with reassurance, rest and advised plenty of oral fluids.

TABLE NO 9 - COMPARISON OF STENTED AND NON STENTED PATIENTS FOR HEMATURIA.

Stent status	No hematuria	Hematuria present	Total
Non stented	33	2	35
Stented	28	7	35
Total	61	9	70

p=0.67

Although the incidence of hematuria was considerably higher in the stented than in the non stented group (20% vs 5.7%), it was not statistically significant (p>0.005), as calculated by the chi square test.

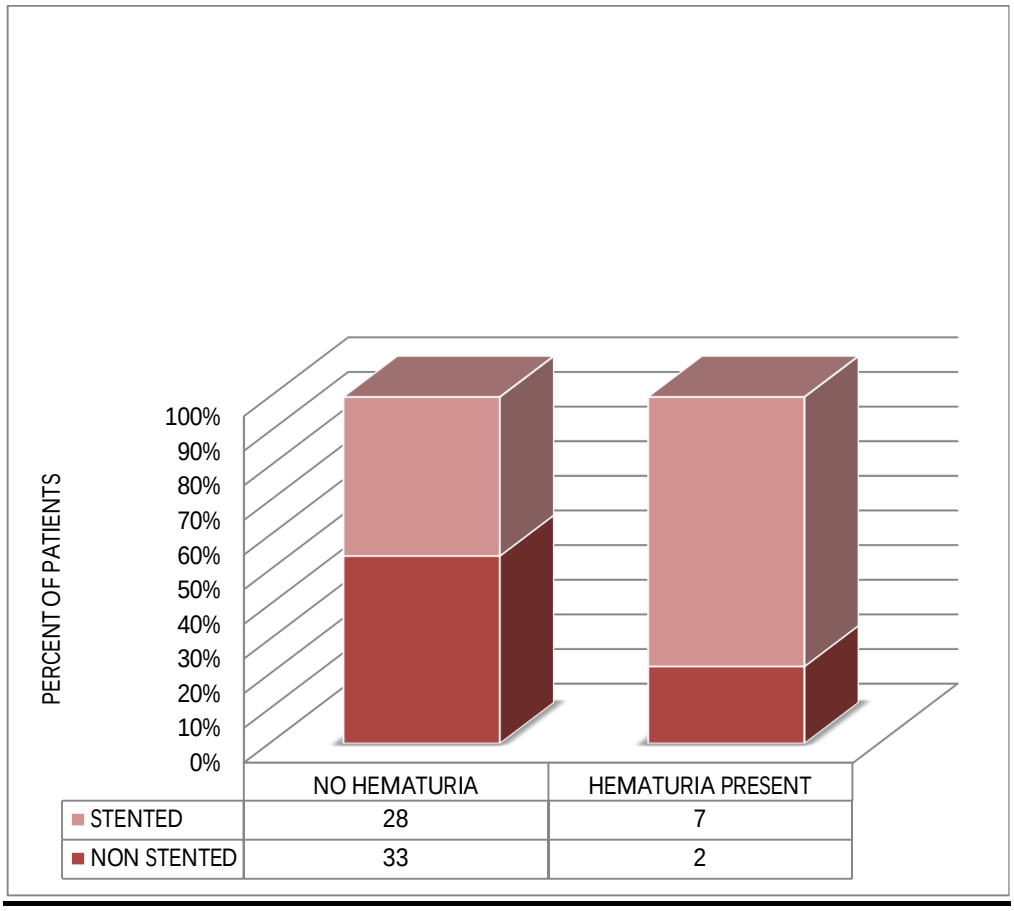


CHART 7: **Chart depicting the incidence of hematuria in the study group (stented and non stented). hematuria was observed in 7 stented and 2 non stented patients . statistical significance was not established (p=0.67)**

DISCUSSION

Urolithiasis is one of the most common and oldest diseases of urinary tract[29]. Now days, ureteroscopy is one of the common procedures among variety of endourological surgeries and is being done for number of indications including ureteroscopic stone fragmentation and its removal. Stenting after ureteroscopy has been recommended to prevent the development of ureteral stricture, it also facilitates passage of stone fragments and promotes ureteral healing after ureteroscopy. In 1999, Hosking et al have concluded that routine placement of ureteral stent following uncomplicated ureteroscopic removal of distal ureteral stones was not necessary[30] and same observation was seen in our study. A few prospective randomized trials have recently been reported in the literature, and all showed no difference in stone free status between stented and nonstented groups[31,32,33]. In our study, irritative voiding symptom of urinary frequency in the stented group was observed in 51.4% of patients, as compared to 14.2% of patients in the non-stented group. These results were comparable with all above mentioned studies

where they claim that post operative pain and irritative voiding symptoms were reduced with omission of ureteric stents.

Routine placement of ureteral stent after ureteroscopy increases the overall cost of the procedure[34]. In our study ,non stented group was cost effective as compared to stented group and same was reported by Netto et al [35]. They assessed that cost effectiveness of ureteroscopy in non stented group was cheaper by 30%. Furthermore, removal of the stent using local anesthesia is more traumatic than the initial ureteroscopy procedure using regional (spinal) anesthesia. The patient has to be subjected to yet another invasive procedure, with its attendant complications of urinary tract infection, fever and stricture formation in the long term. The incidence of hematuria and fever are higher in the stented than in the non stented group, as witnessed in our study, even though there is not enough statistical significance.

Postoperative pain in our study was less in non stented group (17.1%) as compared to stented group(48.5%). The increased intrapelvicrenal pressure, especially while voiding, explains this increased incidence of pain. Ramsay et al demonstrated in porcine

model that ureteral intubation caused an increase in intrapelvic renal pressure which was the reason for more pain in the patients with stent[36].

The development of ureteral stricture is a well-established longterm complication following ureteroscopy. However, the incidence of ureteral stricture is dramatically decreased in recent years due to the advancements made in endourological technology. In this study no stricture formation was found as compared to the other studies. However, the period of follow up has to be extended for assessing stricture of the ureter. Hence, stricture was not included as a variable in our study.

CONCLUSION

CONCLUSION

- Stenting of the ureter has its own side effects of irritative voiding symptoms, pain, hematuria, urinary tract infection, fever.
- Stenting of the ureter following ureteroscopy has to be done taking factors like stone site, size, degree of impaction , bleeding, associated edema, difficulty encountered in negotiating the ureteric orifice into consideration .
- The side effects and complications associated with stenting of the ureter should be weighed against the advantages offered by stenting, depending on the intra operative ureteroscopy findings.
- Routine placement of ureteral stent is not necessary in uncomplicated cases of ureteric calculi following ureteroscopy, the decision being made on the basis of intra operative findings, where the risks clearly outweigh the benefits offered by stenting.
- The option of not stenting the patient following ureteroscopy should be considered for lower and distal ureteric calculi than

proximal ureteric calculi, clearly the decision being based on intra operative findings.

- Stented patients need yet another invasive procedure for stent removal, which increases patient morbidity as well as the overall cost of the procedure.

APPENDIX

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BIBLIOGRAPHY

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PROFORMA

PROFORMA

1) Name:

2) Age :

3) OP/ IP No:

4) Address and Phone No:

5) History:

   - H/O loin pain
   - H/O dysuria / hematuria / calculuria
   - H/O Diabetes / Hypertension

6) General Physical Examination :

   - Pallor / icterus / cyanosis / Pulse / B.P.

7) Systemic Examination :

   - CVS :
   - RS:
   - CNS:
   - P/A :

Examination of Ext. Genitalia and Testes:

   - Digital Rectal Examination :

8) Investigations :

- CBC
- RBS RFT
- Plain X-ray KUB

  Stone side

  Site

  Size
- Ultrasound KUB

  Stone side

  Site

  Size

  hydroureteronephrosis-grade
- Intra Venous Urogram

  Stone side

  Site

  Size

hydroureteronephrosis-grade

excretion status of both kidneys

- INTRAOPERATIVE FINDINGS

Stone side

Site

Size

Stent status (stented / non stented)

MASTER CHART

MASTER CHART FOR STENTED GROUP OF PATIENTS

Serial No	Name	Age/Sex	IP No	Diagnosis	Size of calculus	pain	frequency	hematuria	fever
1	subramani	38/m	30778	right lower ureteric calculus	6 mm	yes	no	no	no
2	shanmugam	30/m	33283	left midureteric caculus	8 mm	yes	yes	no	no
3	sakthivel	36/m	35057	left midureteric calculus	8 mm	no	no	no	no
4	thirunavukarasu	25/m	37145	right vesicoureteric Junction calculus	7 mm	yes	yes	no	no
5	saroja	53/f	36865	left vesicoureteric Junction calculus	6 mm	no	no	no	no
6	pavithra	20/f	38274	left lower ureteric calculus	9 mm	yes	yes	no	yes
7	william john	47/m	39381	left lower ureretic calculus	6 mm	yes	no	no	yes
8	venkatesan	35/m	38769	right lower ureteric calculus	6 mm	no	no	no	no
9	thanikachalam	47/m	40470	left lower ureretic calculus	7 mm	yes	yes	yes	yes
10	parthasarathy	56/m	41543	right vesicoureteric Junction calculus	8 mm	yes	no	yes	yes
11	shakthi	41/m	41302	right vesicoureteric Junction calculus	9 mm	yes	yes	yes	no
12	solai	43/m	42737	left vesicoureteric Junction calculus	8 mm	no	yes	no	no
13	bhakthavakchalam	28/m	44507	right vesicoureteric Junction calculus	9 mm	yes	no	yes	no
14	chitra	24/f	3972	right vesicoureteric Junction calculus	9 mm	yes	yes	no	yes
15	kannan	23/m	3070	right vesicoureteric Junction calculus	7 mm	yes	yes	no	no
16	devi	50/f	4806	right vesicoureteric Junction calculus	10 mm	yes	yes	no	yes
17	kamali	13/f	4841	right vesicoureteric Junction calculus	7 mm	no	no	no	no
18	vijaya	35/f	5684	right vesicoureteric Junction calculus	10 mm	yes	yes	no	no

19	rafeeq ahmed	43/m	5352	right lower ureteric calculus	9 mm	no	no	no	no
20	venkatesan	40/m	6003	left lower ureretic calculus	8 mm	no	no	yes	yes
21	kamala	50/f	6116	right lower ureteric calculus	14 mm	no	yes	no	no
22	prem kumar	23/m	6505	left vesicoureteric Junction calculus	8 mm	no	no	yes	no
23	selvi	21/f	7125	right lower ureteric calculus	7 mm	no	no	no	no
24	sethulakshmi	29/f	6658	right lower ureteric calculus	10 mm	no	yes	yes	no
25	sujatha	41/f	9142	left lower ureteric calculus	12 mm	yes	yes	no	no
26	gowthami	24/f	9089	right lower ureteric calculus	9 mm	no	no	no	no
27	venkatesan	48/m	10075	left lower ureteric calculus	9 mm	no	no	no	yes
28	ravi kumar	52/m	9112	left lower ureteric calculus	14 mm	yes	yes	no	no
29	elumalai	35/m	11293	right lower ureteric calculus	9 mm	no	no	no	yes
30	allabasha	38/m	11548	left lower ureteric calculus	10 mm	yes	yes	no	no
31	murugammal	52/f	11522	left lower ureteric calculus	9 mm	no	yes	no	no
32	yuvaraj	25/m	16741	left midureteric calculus	6 mm	no	no	no	no
33	vijaya	31/f	17754	left lower ureteric calculus	9 mm	no	yes	no	no
34	arun	18/m	17645	right lower ureteric calculus	11 mm	yes	yes	no	yes
35	iyappan	14/m	17626	left lower ureteric calculus	11 mm	no	no	no	no

MASTER CHART FOR NON STENTED GROUP OF PATIENTS

Serial no	Name	Age/Sex	IP no	Diagnosis	size of calculus	pain	frequency	hematuria	fever
1	shanthi	30/F	28335	right lower ureteric calculus	8 mm	no	no	no	no
2	baskar	33/M	29168	right vesicoureteric junction calculus	8 mm	no	no	no	no
3	sundari	45/M	36784	left lower ureteric calculus	8 mm	yes	no	no	no
4	jeyalakshmi	15/F	2978	right vesicoureteric junction calculus	7 mm	no	no	no	no
5	kumar	21/M	5865	right lower ureteric calculus	12 mm	no	yes	yes	no
6	ajay	13/M	6062	left vesicoureteric junction calculus	9 mm	yes	no	no	no
7	surya	27/M	8589	left vesicoureteric junction calculus	10 mm	no	yes	no	yes
8	muniyammal	47/F	9115	left lower ureteric calculus	10 mm	yes	no	no	no
9	chitra	2/F	16090	left lower ureteric calculus	9 mm	no	yes	yes	no
10	arumugam	30/M	15894	right vesicoureteric junction calculus	7 mm	yes	no	no	no
11	hussaun	28/M	17149	left lower ureteric calculus	6 mm	no	no	no	no
12	mathias	50/M	17618	left lower ureteric calculus	7 mm	no	no	no	no
13	sethulakshmi	27/F	17630	right lower ureteric calculus	8 mm	no	yes	no	no
14	ramesh	29/M	19167	left lower ureteric calculus	9 mm	no	yes	no	yes
15	arulmozhi	49/F	18660	left lower ureteric calculus	9 mm	no	no	no	no
16	narayanan	24/M	19170	left vesicoureteric junction calculus	8 mm	no	no	no	no
17	amala	25/F	20458	right mid ureteric calculus	7 mm	no	no	no	no
18	kamala	35/F	20809	right mid ureteric calculus	6 mm	no	no	no	no

19	maheshwari	45/F	21331	right lower ureteric calculus	11 mm	yes	no	no	yes
20	gnanaprakasam	55/M	22083	right vesicoureteric junction calculus	8 mm	no	no	no	no
21	peter	63/M	24182	right lower ureteric calculus	9 mm	yes	no	no	no
22	kaveri	42/F	24228	left vesicoureteric junction calculus	8 mm	no	no	no	no
23	neela	46/F	28476	left vesicoureteric junction calculus	9 mm	no	no	no	yes
24	kamalakannan	34/M	33610	left lower ureteric calculus	6 mm	no	no	no	no
25	devi	53/F	30754	left vesicoureteric junction calculus	7 mm	no	no	no	no
26	raja	27/M	40076	right lower ureteric calculus	6 mm	no	no	no	no
27	radha	18/F	39882	right lower ureteric calculus	6 mm	no	no	no	no
28	vairamuthu	23/M	41695	right vesicoureteric junction calculus	6 mm	no	no	no	no
29	lingam	49/M	41479	left lower ureteric calculus	6 mm	no	no	no	no
30	prabhu	22/M	42580	left vesicoureteric junction calculus	6 mm	no	no	no	no
31	vijayalakshmi	43/F	1419	right lower ureteric calculus	7 mm	no	no	no	no
32	siluvai antony	51/M	51439	left lower ureteric calculus	7 mm	no	no	no	no
33	sandhya	23/F	51438	right vesicoureteric junction calculus	8 mm	no	no	no	no
34	jackson paul	25/M	5295	right vesicoureteric junction calculus	8 mm	no	no	no	no
35	sekar	43/M	57045	right vesicoureteric junction calculus	7 mm	no	no	no	no